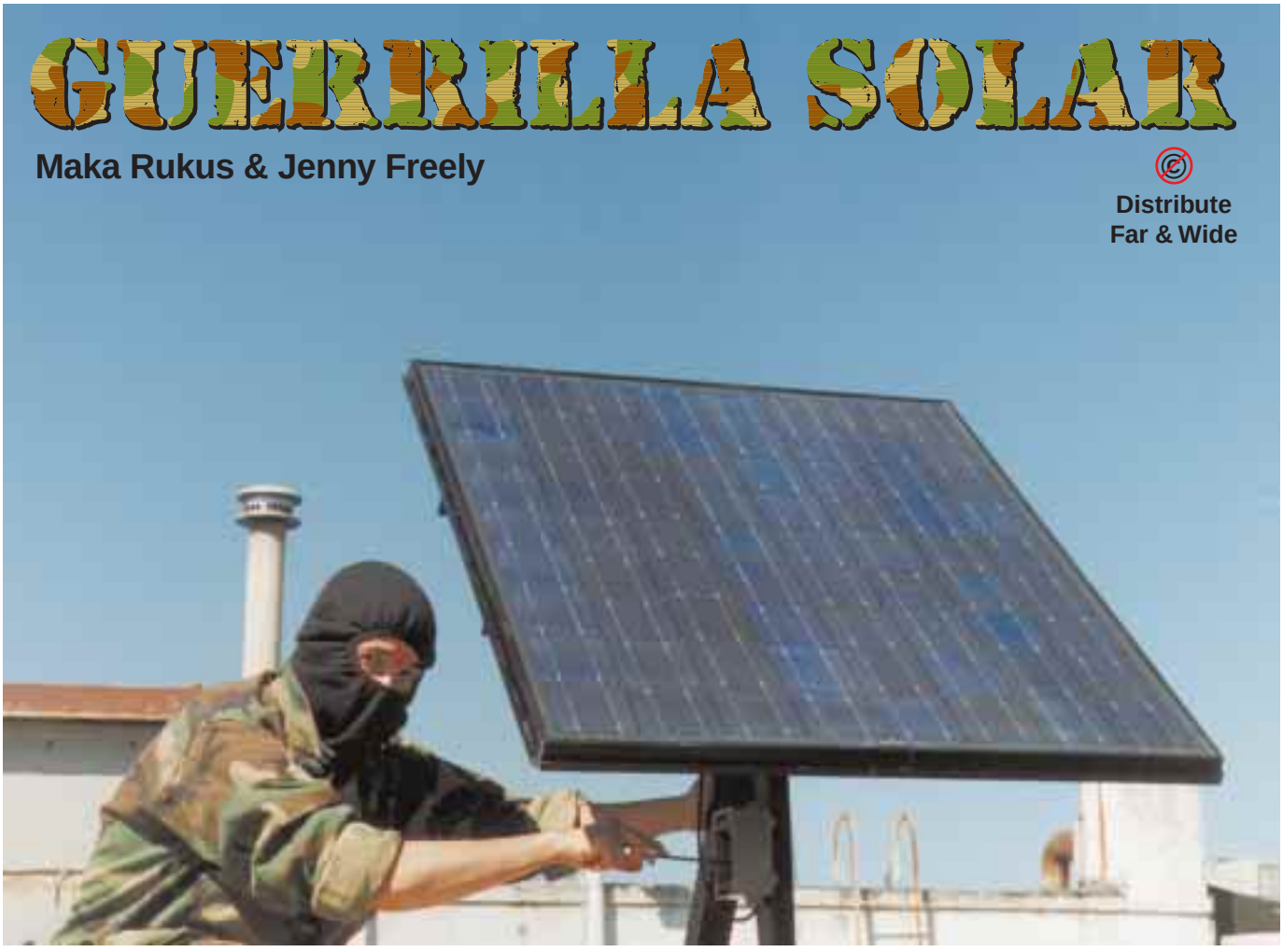
GUERRILLA SOLAR

Maka Rukus & Jenny Freely

Distribute Far & Wide



It was a bright and calm spring morning. Two shadowy figures emerged from an unmarked van. It was so plain, so ordinary, that if anyone had been around, they would not have noticed the activity on the otherwise deserted city street.

One person was carrying a long case with a handle. The form quietly stepped across the sidewalk and glanced in both directions. In a graceful, practiced manner, a key was eased into the lock of the building. The figure slipped inside so quickly that it seemed as if no one had even been there.

The other person moved cat-like, gently closing the side door of the van. In through the unlocked door of the building, the second was soon behind the first—carrying a thin but somewhat unwieldy cardboard box about four feet square. It was carried as if it were precious cargo, like an expensive 17th century painting by one of the masters. The door clicked shut, and locked.

They were pros. This was guerrilla solar.

Chapter One

Earlier this year, we made a toll-free phone call to Alternative Energy Engineering (AEE) in Redway, California. A new solar product was on the market, and we were excited to check it out. We ordered the new "AC Module." This 108 Watt 24 Volt PV panel has Trace Engineering's Micro Sine inverter glued to the back. The inverter box on the module back is not much larger than the junction box itself. The inverter is pre-wired into the module's junction box, and has a long, thin, four-wire cable coming out of the side. A standard wall plug is wired onto the end of two of the wires, and then inserted into an ac receptacle inside the building.

Our intentions are honorable, but less than legal. We did not tell the utility that we were going to feed homemade electricity back into their power grid. This wasn't a decision arrived at lightly. Any revolutionary action should have all of the potential consequences weighed carefully before proceeding. In this case, we knew the risks would be minimal—unlike blockading a nuclear power plant where arrest was likely. We felt that the worst scenario would be the utility shutting off our power until we de-installed the illegal PV system.

Safety Isn't the Issue

Every utility puts high priority on making things safe for

their line workers. However, utility management has begun to use safety as an excuse to make it difficult for us to install intertie RE systems. The power industry doesn't fear lack of safety, they fear the revolutionary renewable energy movement. They fear that they will slowly lose control over their one-hundred-year power generation monopoly. They have good reason to fear people like us, but they can only delay the inevitable.

At a minimum, utilities require an expensive, lockable disconnect to keep your power out of their grid while they are working on it. The supposed problem is that a PV system feeding power to the grid could keep doing so when the grid goes down. This would put the line workers in jeopardy of being shocked when they are not expecting live powerlines. But modern intertie inverters are designed to sense the presence of grid power, shutting off when the grid does.

Imagine that there are two intertie systems in a neighborhood. When the grid goes down, what if they sense each other and continue feeding power? What happens if the load in the neighborhood is equal to what the inverter can put out? When an inverter continues to run when the grid goes down, it's called "islanding." PG&E, a California utility, ran extensive tests on Trace's SW series of intertie-capable inverters. They found no circumstances where these inverters would continue running when the grid went down—they do not island. Yet utilities, even PG&E, continue to require a disconnect on every intertie system installed. You know the real reason why.

Some utilities also require multi-million dollar insurance policies on the intertie. Those two requirements are often enough to discourage folks from installing on-grid systems.

Is this fair? Is it OK? No, and it rubs us just wrong enough to decide to do it without permission, without disconnects, and without additional insurance. Hence, guerrilla solar.

The Installation

Our installation was easy and fast. We lag-screwed a length of 1/4 by 2 by 2 inch steel angle iron straight up the side of our building. We left enough length above the roof line to be able to seasonally adjust the module tilt. Then, we bolted the backing from a pole mount rack to the AC Module, leaving out the part that would normally fit over the pole. Since our building faces nearly south, we were able to bolt the rack directly to the angle iron.

Not being engineers who can calculate wind loads on paper, we field-tested the mounting system. We wiggled it back and forth as if it was blown by a gusty wind. There was too much flex in the hefty angle iron,

Above: The Micro Sine on the back of the 24 Volt PV.

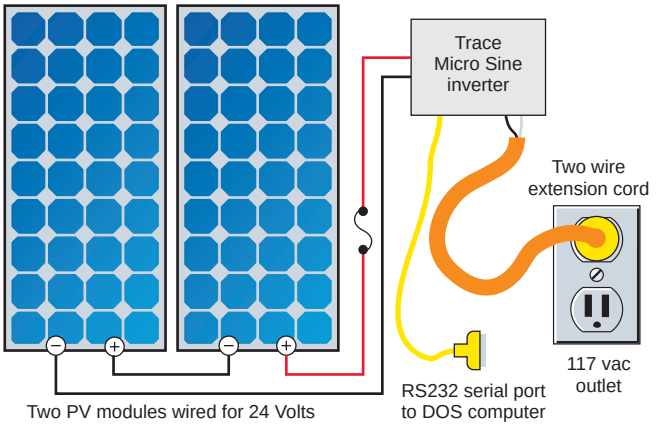
because it extended a fair distance above the topmost lag screw. We added a brace from the top of the post to the side of the building. This created a solid triangle supported in the direction of likely wind load. With the brace, the angle iron barely moved when we pushed hard against the module. We were satisfied.

Next, we cut the inverter output cable. We rewired it through a waterproof box mounted just below the module. This way, we can remove the AC Module without having to deal with the long cable that snakes down and through the outer wall. We put a standard household plug on the two ac output wires at the inside end of the long four-wire cable.

We (Kinda) Inform the Utility

As we were working on the installation, a utility line crew showed up to work on some underground cable in the alley below. The next time we had to go down to get more hardware, we stopped to say hello to the hardhats. We took the opportunity to point up to the newly-mounted PV module and said, "Look, friends, we are putting up a solar panel." Their reaction was predictable. They looked up with slight curiosity, while

Wiring the Trace Micro Sine



some nodded and some grunted a minor interest. They looked back in their hole, went back to work, and left us to our task.

So, we had shown the utility our illegal installation. Would telling their worker bees be enough to satisfy the utility that we had done proper notification? Would word of our illegal system likely find its way back to utility management? No, but it was enough to give us a great anecdote while spreading the tale of our guerrilla solar electric system.

Below: Logging data.

Above: Just plug it in!

The Other Two Wires

We plugged it in, and our installation was fait accompli. We wanted to find out if it was working, but how could we tell? 100 watts peak, in a serious load like our building has, wouldn't show a noticeable reduction in the wheel speed of the utilitie's kWh meter. We could have temporarily put an amp meter in series with one leg of the wire, but there was another method available.

Every Micro Sine inverter has an internal data collector. It doesn't matter whether the inverter is mounted on an AC Module or not. It tracks real-time DC module voltage, ac output voltage, current, watts, and total watt hours. It also measures the temperature where the inverter is glued to the PV module. An optional serial port computer interface module is available with special software to access the data. The second set of two wires coming out of the inverter hook up to this interface module.

Tech Non-support

Unfortunately, the software that came with the module is only for PCs, and not for Macs. It runs under MS-DOS, but is not Windows-based. We installed it on a Pentium laptop and ran it in DOS mode. We hooked up the interface, but could not get the software to find the inverter. We had a bad experience calling and emailing

Guerrilla Micro Sine Data (Since April 10, 1998)

Date & Time	Aug. 12, 10 a.m.	Aug. 13, 1 p.m.
Weather	overcast	clear
Total watt-hours	46,896	47,354
ac volts	123	123
ac amps	0.074	0.601
ac watts	9	73.8
DC Volts	33.3	31.3
Temperature °C	18.5	49.2

Trace to find out the scoop. We asked the voicemail tech support to call back with information on the Windows version of the software that was supposed to be available. All in all, we left three messages in three different voice mailboxes, but no one ever called back.

Email was answered, but the person who replied didn't pay attention and answered the wrong question. Finally, the light bulb went on—a Trace rep told us that the software for Windows was not available. Trace, if only your tech support matched the quality of your equipment. Hopefully, under Trace's new owners, tech support will improve and the equipment quality will not suffer.

Contrary to what we were told, we had heard from a couple of other sources that Windows software *was* available. These inverters had been around for a while before Trace picked up the US rights. They are not Trace-designed inverters; they were designed and originally marketed by OKE-Services in The Netherlands.

We did a search on the World Wide Web. Soon, we had the software. We loaded the program on a Pentium laptop. OKE had delivered the US version of their software, but we still couldn't get it to work. We gave up on finding the Windows software.

In the meantime, we had successfully installed the DOS-based software on an ancient 80286 portable computer that belongs to a comrade. It ran like a champ, giving access to all of the inverter functions and information that can be had through the software. It turns out that the software and interface is capable of collecting information and managing the online status of lots and lots (127) of these inverters, not just our measly 100 watt system. Additionally, OKE publishes the information on how to access the data communication functions of the inverter, so that folks with technical capabilities can write their own software to do more and better data logging.

The Data

There it was on the computer display, proof that the guerrilla solar electric system was making power. And hang the utility—it was done safely for the line workers, and safely for the building.

After four months of use, the AC Module has offset 47,354 watt-hours of consumption in our building. It's a small amount—at ten cents per kWh, that's less than $5. It would take a lot of time to make up for our expenses, but we are not really interested in payback time. We are interested in contributing our fair share to a more just, distributed power system. Oh yeah, we also get a kick out of pulling one over on the utility.

Above: Freedom on the roof!

Yesterday started very overcast, and the inverter was putting out only 9 watts. Today after the fog burned off, we have seen close to 75 watts. On a sunny day with no haze, we have seen it put out just above 82 watts.

AEE says that the inverter will handle up to 130 Watts of PV, and that the UL listing should be complete and on any inverters manufactured after August, 1998. On the OKE website, it says that their 300 watt inverter "is" due out in 1997, but there is no indication of availability yet. In fact, that web site hasn't been updated since August, 1996.

Guerrillas Unite!

You can do this too. We hope you do—and we want to hear about your experiences. The Micro Sine inverter is not the only way. The same thing can be accomplished on a much larger scale. We'd like to try a Trace SW2512 inverter, an array of eight or more 100 Watt modules, a small battery bank and charge controller for when the grid is down, and, of course, the appropriate fusing and breakers.

Our flat roof is wide enough to hide the array from nosy utility employees and building inspectors on the ground. That brings up the last, very important point. Most legal

Guerrilla Solar Costs

Item	*Cost*	*%*
AC Module	$895	79.3%
OK485 Communications Adapter	$125	11.1%
Scavenged Mount	$65	5.8%
Angle Iron	$27	2.4%
Miscellaneous Hardware	$17	1.5%
Total	$1,129	

intertie systems are over-built in order to satisfy the rules of the utilities and the needs of building inspectors for unreasonably full NEC compliance. Our small system would satisfy neither, but is very safe with its built-in protection. It's up to any guerrillas installing larger systems to take the necessary safety steps, just like a well-designed off-grid system. Don't worry about the utility, these inverters are safe.

Access

Authors: (Hah! Did you think it would be that easy?) Send email to hp@homepower.com and HP staff will pass it on when we check in.

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